United States Enrichment Corporation (USEC)
Air Emissions Annual Report
(Under Subpart H, 40 CFR 61.94)
Calendar Year 1997

Site Name: Portsmouth Gaseous Diffusion Plant

Site Information

Operator: United States Enrichment Corporation

Address: Post Office Box 628
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Piketon, Ohio 45661

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Owner: U.S. Department of Energy
Portsmouth Site Office

SECTION I. FACILITY INFORMATION

SITE DESCRIPTION

The Portsmouth Gaseous Diffusion Plant (PORTS) is owned by the Department of Energy (DOE). PORTS was operated by DOE and managed by Martin Marietta Energy Systems, Inc. (now Lockheed Martin Utility Services, Inc.), until July 1, 1993. In 1992 Congress passed legislation amending the Atomic Energy Act of 1954 to create the United States Enrichment Corporation (USEC), a government corporation, to operate the uranium enrichment enterprise in the United States. The new corporation began operation on July 1, 1993. In accordance with the Act, USEC leased all production facilities at PORTS and its sister plant at Paducah, Kentucky, from DOE. DOE retained operational control of all waste storage and handling facilities as well as all sites undergoing environmental restoration.

The PORTS site is located in sparsely populated, rural Pike County, Ohio, on a 16.2-km^2 (6.3-mile^2) site about 1.6 km (1 mile) east of the Scioto River Valley at an elevation of approximately 36.6 m (120 ft) above the Scioto River floodplain. The terrain surrounding the plant, except for the Scioto River floodplain, consists of marginal farmland and densely forested hills. The Scioto River floodplain is farmed extensively, particularly with grain crops.

Pike County has a generally moderate climate. Winters in Pike County are moderately cold, and summers are moderately warm and humid. The precipitation is usually well distributed with fall being the driest season. Prevailing winds at the site are out of the southwest to south. Average wind speeds are about 5 mph (8 km/h) although winds of up to 75 mph (120 km/h) have been recorded at the plantsite. Usually, high winds are associated with thunderstorms that occur in spring and summer. Southern Ohio lies within the Midwestern tornado belt although no tornados have struck the plantsite to date.

Pike County has approximately 23,000 residents. Scattered rural development is typical; however, the county contains numerous small villages such as Piketon, Wakefield, and Jasper, which lie within a few kilometers of the plant. The county's largest community, Waverly, is about 19 km (12 miles) north of the plantsite and has a population of approximately 5,100 residents. Additional population centers within 80 km (50 miles) of the plant are Portsmouth (population 25,500), Chillicothe (population 23,420), and Jackson (population 6,675). The total population of the area lying within an 80-km (50-mile) radius of the plant is approximately 600,000.

USEC is responsible for the principal site process and support operations. The principal site process is the separation of uranium isotopes through gaseous diffusion. Support operations include the feed and withdrawal of material from the primary process, treatment of water for both potable and cooling purposes, steam generation for heating purposes, decontamination of equipment removed from the process for maintenance or replacement, recovery of uranium from various waste materials, and treatment of industrial wastes generated onsite. DOE is responsible for the X-326 "L-Cage" and its glovebox, the X-345 high assay sampling area (HASA), the X-744G glovebox, and site remediation activities. Because of the separation of responsibilities, DOE and USEC are submitting separate Annual NESHAP Reports and are certifying only those activities for which they have direct responsibility. Following is a description of USEC's emissions sources.

SOURCE DESCRIPTION

Radionuclides Used at the Facility

As discussed above, the principal site process is the separation of uranium isotopes. Large quantities of UF_6 are located on the site. UF_6 partially enriched in the ^{235}U isotope is received from the Paducah Gaseous Diffusion Plant located in Paducah, KY. This UF_6 also contains trace quantities of other radionuclides that came from DOE's practice during the years 1953 to 1975 of intermittently feeding reactor tails from government reactors in addition to the UF_6 typically used. The only radionuclide that is detectable in emissions from PORTS is technetium-99 (^{99}Tc). PORTS also uses a variety of sealed sources for calibration of equipment; however, none of these are released and therefore are not used in the determination of dose. Table 2.2 lists the radionuclides used in the determination of dose.

Monitored and Unmonitored Sources

The sources discussed in this section are the significant or potentially significant contributors to airborne radionuclide emissions due to USEC operations. These sources were grouped into 9 sources, each of which was then modeled using the CAP88 computer model.

In 1991, DOE ceased production of Highly Enriched Uranium (HEU) and Very Highly Enriched Uranium (VHE). Between October 1992 and October 1996, DOE removed the residual uranium from the part of the gaseous diffusion cascade that produced those materials and placed the equipment in long shutdown. The dose rose to its historic maximum of 0.91 mrem (0.0091 mSv) in 1993 due to unexpected emissions of technetium which were caused by cleanup activities associated with the shutdown. By 1996, the dose returned to more normal levels of approximately 0.1 mrem (0.001 mSv) per year. Section IV of this report contains a summary of the annual doses since 1990.

In 1995 PORTS began including emissions estimates from unmonitored sources (using the 40 CFR 61 Appendix D emissions factors) in the calculation of the EDE. Including the conservative estimates from those sources caused the calculated dose to double from the 1994 figure. The majority of the dose came from the X-326 Top Purge, Side Purge, E-jet vents and the X-705 Decontamination Facility. The majority of the dose from the X-326 Top Purge, Side Purge and E-jet vents was due primarily to technetium emissions. The majority of the dose from the X-705 Decontamination Facility was also due to technetium. Technetium emissions from the Cascade decreased from 0.641 curies in 1996 to 0.0475 curies in 1997. The judgement that no other significant sources exist at PORTS is supported by ambient air monitoring data. This data indicates the ambient airborne radionuclide concentrations are within standard modeling accuracy of the ambient concentrations predicted from the measured emissions of the 13 sources and emissions estimates from the remaining 22 sources.

PORTS determined that 13 of the radionuclide sources had the greatest potential for emissions and equipped them with continuous emissions monitors (samplers) (See Table 1.0). All 13 are continuously sampled by flow-proportional, isokinetic samplers to provide emissions data. Six of these sources (the purge cascades, the cold recovery systems, and the building wet air evacuation systems) are also monitored in real-time by ionization chamber instruments for operational control. The Continuous Emissions Monitors (samplers) are more sensitive, more accurate, and more reliable than the ionization chambers but cannot provide real-time data required for process control. The ionization chambers also provide early warning of upset conditions in the diffusion process.

Table 1.0 PORTS Continuously Monitored Emissions Points.

Location	Stack & Vent Identification Number
X-326 Top Purge Vent	X-326-P-2799
X-326 Side Purge Vent	X-326-P-2798
X-326 Emergency-Jet Vent	X-326-P-616
X-326 Seal Exhaust Vent 6	X-326-A-540
X-326 Seal Exhaust Vent 5	X-326-A-528
X-326 Seal Exhaust Vent 4	X-326-A-512
X-330 Seal Exhaust Vent 3	X-330-A-279
X-330 Seal Exhaust Vent 2	X-330-A-262
X-333 Seal Exhaust Vent 1	X-333-A-851
X-330 Cold Recovery/Building Wet Air Evacuation Vent	X-330-A-272
X-333 Cold Recovery Vent	X-333-P-852
X-333 Building Wet Air Evacuation Vent	X-333-P-856
X-344 Gulper Vent	X-344-P-929

MONITORED SOURCES

Top and Side Purge Cascades

The two purge cascades continuously separate light gases from process gas (UF_6) using gaseous diffusion. The separated process gas is returned to the main cascade from the tail of the purge cascades. The light gases are split at the head of the purge cascades with enough "lights" being recycled to the main cascade to maintain normal operating flows and the balance are vented through chemical adsorbent traps to the atmosphere. The Side Purge Cascade and Top Purge Cascade (Emergency jet vent is used to handle excess flow from either the Top or Side Purge Cascades) operate in series at the very head of the main cascade.

Continuous operation of the purge cascades is required for continued operation of the main process cascade. Consequently, the two purge cascades are exhausted by three interconnected air jet eductors. The third eductor is an operating spare for either or both regular eductors to an interconnected set of four exhaust pipes. The pipes extend up a 50-meter free-standing tower to remove the emissions from the building's wind wake.

Seal Exhaust Stations

The seal exhaust (SE) stations maintain a vacuum within cascade compressor shaft seals to prevent inleakage of wet air to the cascade. This vacuum is isolated from the compressor side of the seal by a buffer zone. Gases evacuated from the seals are pulled through chemical adsorbent traps by a bank of manifolded vacuum pumps and exhausted to the atmosphere through mist eliminators (for pump oil) and a roof vent.

There is one seal exhaust station in each of the cascade's six "areas," each is located adjacent to the: area control room. Area 1 includes the entire X-333 process building. This station was equipped with a continuous emission monitor (vent sampler) in late 1989, which confirmed that the emissions were not a significant contributor to plant radionuclide emissions.

Radionuclide emissions from the other five seal exhaust stations should be very low compared to the X-333 Area 1 Seal Exhaust Station during normal operation. To confirm this and to provide for the possibility of unplanned releases, continuous emissions monitors (samplers) were installed on these five vents in 1991 and began operation the first week of 1992.

Cold Recovery Systems

The cold recovery systems are intermittently-operated maintenance support systems used to prepare cascade equipment (cells) for internal maintenance. Process gas in cascade cells scheduled for maintenance is first evacuated to adjacent cascade cells to the extent practical. The cell is then sealed off and alternately purged with dry nitrogen and evacuated repeatedly. The evacuated gases pass through chilled cylinders called "cold traps" to solidify any residual process gas. The non-condensible nitrogen carrier is passed through chemical adsorbents for polishing and then is vented by an air jet educator to the atmosphere. Periodically, individual cold traps are valved off from the vent, and the trapped UF_6 is returned to the cascade by vaporization. There are two cold recovery systems operated at PORTS with one each in the X-330 and X-333 process buildings. In X-330, the cold recovery system shares a common vent and vent sampler with the building evacuation system.

Building Wet Air Evacuation Systems

The building wet air evacuation systems are intermittently-operated maintenance support systems used to prepare off-line cascade cells for return to service. The cell is sealed off and alternately purged with dry nitrogen and evacuated to remove all outside air and moisture from the cell. The evacuated gases are passed through chemical adsorbents to catch residual radionuclides (if any) and vented to the atmosphere by an air jet educator. There are two building wet air evacuation systems, one associated with each of the cold recovery systems described above. In X-330, the cold recovery and building wet air evacuation system share a common vent and sampler.

X-344A Manifold Evacuation/Gulper

The X-344A Toll Transfer Facility contains an automated sampling and transfer system for sampling the product and for filling customer cylinders with low assay UF_6. To avoid cross contamination between samples and to prevent emissions to the air, the sampling and transfer manifold is evacuated back to the diffusion cascade through a line to the X-342 Feed Vaporization and Fluorine Generation Building. In the event of a trace release occurring in spite of the purge and evacuate procedure, a "gulper" is mounted behind the manifold-to-cylinder connections. The gulper is simply a continuous vacuum nozzle, similar in principal to a lab hood, which draws any small releases from the room air into a filtration system. The filtration system has two filter banks, each consisting of a roughing filter followed by high efficiency particulate air (HEPA) filters and a centrifugal blower.

UNMONITORED AND POTENTIAL SOURCES

PORTS has several unmonitored minor and potential emission sources associated with USEC process support activities. Based on process knowledge and ambient monitoring data, none of these sources are believed to contribute significantly to plant radionuclide emissions under normal operations.

The minor sources, as the term is used at PORTS, have some trace radionuclides in their routine emissions but only in negligible amounts under normal operating conditions. The potential sources are primarily room ventilation exhausts and/or pressure relief vents from areas that have a potential for internal radionuclide release.

Since 1995, PORTS has included emissions estimates from unmonitored sources in the calculation of the EDE.

X-705 Decontamination Facility

Equipment that is removed from the PORTS cascade is sealed at the point of removal and transported to the X-705 Decontamination Facility. Small parts are cleaned in "hand tables" or spray tanks, while large parts are sent through the automated "tunnel." The hand tables consist of shallow acid baths (either nitric or citric depending on the metal to be cleaned) where metal parts are decontaminated by passive soaking. The hand tables have fume hoods over them to protect workers from acid fumes. The spray tanks are enclosed tanks where equipment can be spray cleaned remotely. Pressure relief vents are standard on such equipment. The tunnel is an enclosed series of "booths" that decontaminate large parts by spraying with decontamination solutions (acids and water rinses) as a small rail car carries the parts through the tunnel. The tunnel is ventilated to prevent a buildup of acid fumes. In all cases, radionuclides (uranium and technetium) are dissolved in the liquid phase and collected for recovery of the uranium. None of the radionuclides are volatilized by normal operations of these facilities and only trace radionuclides carried by entrained droplets would be expected.

X-705 Calciners

Decontamination solutions are treated to yield a concentrated aqueous solution of uranyl nitrate, which is converted into uranium oxide powder in one of three calciners located in the X-705 decontamination building. A calciner consists of an inclined heated tube with the uranyl nitrate solution entering at the top and air entering at the bottom. The uranium is first dried and then oxidized as it passes down the tube. The uranium oxide powder is collected directly in a five-inch diameter storage can at the lower end of the calciner tube. The gaseous stream leaves the upper end of the calciner and is exhausted through a scrubber for NO_x control. Uranium is recovered from the spent scrubber solution through a microfiltration process and the effluent is discharged to a National Pollutant Discharge Elimination System permitted outfall. Turbulence and flow rates through the calciners are controlled to minimize blowback of the uranium oxide. Any blowback that does occur is entrapped by the entering uranium solution.

X-705 Glove Boxes

The five-inch can that collects the uranium oxide powder from each calciner is housed in a glove box to prevent the loss of the material. In addition, there is a separate glove box which is used for sampling the material in the can. The gloveboxes have air locks for the entry and removal of work materials and are maintained under negative pressure during use. This negative pressure is produced by an exhaust fan drawing through a HEPA filter.

X-705 Storage Tank Vents

Uranium-bearing solutions awaiting treatment are stored in a manifold of five-inch diameter tanks inside the X-705 facility. All of these tanks are manifolded to a common pressure relief vent that has some potential to release radionuclides if the tanks are overfilled or overheated. Normal emissions should be zero since the stored liquids are quiescent, the dissolved radionuclides are non-volatile, and the vents are not open except during filling.

Emissions estimates from sources in the X-705 Decontamination Facility are included in the EDE calculations. Emissions from X-705 were modeled as a single source. The X-705 Facility was the predominant emissions source in 1997. The emissions from X-705 were estimated using the factors given in the Code of Federal Regulations, Title 40, Part 61, Appendix D and are extremely conservative.

Laboratory Fume Hoods

Laboratory analysis of process and other samples is performed in the PORTS on-site laboratory in accordance with standard laboratory practices. There are no emissions controls on the lab hoods used in these procedures. The hoods should not see any measurable radionuclide emissions during normal operation. Small amounts of technetium are partially volatilized by the analytical method approved by the Environmental Protection Agency under the Safe Drinking Water Act. There is also a possibility of a UF_6 sample container bursting during processing. This is an extremely rare occurrence, however, and cannot be regarded as normal operation as specified in the NESHAP regulations. Most laboratory fume hoods are located in the X-710 laboratory building. There are two fume hoods in the X-760 Chemical Engineering Building which operates as an adjunct to the X-710 Laboratory. These hoods are used to prepare environmental samples such as soil, water, air, and vegetation samples for analysis in the X-710 Laboratory. The level of radionuclides in these samples is extremely low as evidenced by the analytical results. The X-705 Decontamination Facility has a small laboratory which contains three fume hoods which are used to prepare samples and analyze materials being processed in the building.

Emissions estimates from two sources in the X-710 have been included in the calculations of the EDE. The emissions from the X-710 were modeled as a single source.

Room Air Exhausts

Several uranium handling areas within the plant buildings have some potential for releasing minute ($\leq$1 gram) amounts of UF_6 into the room air. Releases of this size are characterized as small releases (visually resembling a puff of cigarette smoke). However, it should not be implied that any size release is acceptable or overlooked by PORTS. Studies conducted in the early 1980s demonstrated that a release of one gram of UF_6 produces a much larger release (smoke cloud) than what is normally observed during the operations discussed here. Ventilation exhausts from, and worker protection within these areas, are controlled according to the probability of releases occurring. Standard policy in the event of a large internal release is to evacuate the area and remotely close down the local ventilation for confinement and later decontamination.

Material feed and withdrawal areas occasionally have small releases when disconnecting UF_6 containers from process piping. These areas include the X-342A Feed and Fluorine Generation Facility, the X-343 Feed Facility, the X-344 Toll Transfer Facility, the X-330 Tails Withdrawal Area, the X-333 Low Assay Withdrawal Area, and the X-326 Extended Range Product and X-326 Product Withdrawal Area. These areas have dedicated ventilation exhausts for worker protection but no emission controls. There are no Continuous Emission Monitors ("environmental" vent samplers) on these exhausts. The plant's Health Physics (HP) Department continuously samples the air inside these areas for worker protection. The HP data indicates the average radionuclide concentrations inside the room are typically equivalent to natural background and, based on this, emissions from the room can be presumed to be environmentally insignificant.

The highest probability of internal releases besides the X-344A Sampling/Transfer Area, which was discussed in the previous section, is in the X-705 Decontamination Facility South Annex , where contaminated equipment is unsealed and disassembled. The South Annex has a separate HEPA filtered ventilation system and operates as a sealed area. Supplied air respirators are mandated for worker protection within the annex when the facility is in use. Normal emissions to the outside air should be negligible, which is consistent with ambient monitoring performed by the plant's HP and Environmental Departments in the past.

The "cell floors" of the process buildings are subject to a lesser potential for unplanned releases when cascade components are being serviced or removed. Special worker protection ventilation systems for the cell floors are not considered necessary for several reasons, including the huge volume of air passing through the general ventilation systems (approximately 4,000 process motors are air cooled by the general ventilation system) and the lower potential for a release. The cell floor air is continuously sampled by the HP Department. The same results found in the material withdrawal areas are seen on the cell floor. Routine emissions levels from process building ventilation should be equal to natural background levels. Plant procedure in the event of an unplanned release larger than a "small release" is to close the building ventilation system to confine the uranium for decontamination and recovery.

SECTION II. AIR EMISSIONS DATA

Tables 2.0 and 2.1 summarize the control device information for each source and give the distance and direction from each source to the nearest, resident, school, office or business, and farm producing vegetables, meat, and milk.

Table 2.0 Point Sources

Point Source	Control Device	Control Efficiency	Distance in meters to the Nearest:					
			Resident	School	Office or Business	Farm		
						Veg.	Meat	Milk
X-326 Top, Side Purge & E-jet (Cascades) (3 monitors)[a]	Chemical Adsorbents	0-95%[b]	1370 SE	5000 NNW	1520 SSE	4290 N	1370 E	8660 ENE
X-330 Cold Recovery/Wet Air Evacuation Vent	Cold Traps Chemical Adsorbents	90-95%[c] 0-95%[b]	1690 ESE	3930 NNW	1370 W	3200 N	1520 ESE, W	8380 ENE
X-333 Cold Recovery Vent	Cold Traps Chemical Adsorbents	90-95%[c] 0-95%[b]	1330 ESE	3840 NNW	1860 WSW	2960 N	1230 SE	7890 ENE
X-333 Wet Air Evacuation Vent	Chemical Adsorbents	0-95%[b]	1330 ESE	3840 NNW	1860 WSW	2960 N	1230 SE	7890 ENE
X-344A Manifold Evacuation/Gulper	HEPA Filters	99.97%	1830 ESE	3410 NNW	1460 WSW	2680 N	1830 SSE	8320 ENE

See notes on page 11.

Table 2.0 Point Sources, Continued

Point Source	Control Device	Control Efficiency	Distance in meters to the Nearest:					
			Resident	School	Office or Business	Farm		
						Veg.	Meat	Milk
X-326 Seal Exhaust Area 4	Chemical Adsorbents	0-95%[b]	1500 ESE	4420 NNW	1460 WNW	3720 N	1340 E	8470 ENE
X-326 Seal Exhaust Area 5	Chemical Adsorbents	0-95%[b]	1460 E	4630 NNW	1540 WNW	3940 N	1340 E	5830 ENE
X-326 Seal Exhaust Area 6	Chemical Adsorbents	0-95%[b]	1430 E	4880 NNW	1620 SSE	4180 N	1340 E	8630 ENE
X-330 Seal Exhaust Area 2	Chemical Adsorbents	0-95%[b]	1725 ESE	3690 NNW	1430 WSW	3020 N	1580 SE, W	8320 ENE
X-330 Seal Exhaust Area 3	Chemical Adsorbents	0-95%[b]	1620 E	4080 NNW	1400 W	3360 N	1430 E	8400 ENE
X-333 Seal Exhaust Area 1	Chemical Adsorbents	0-95%[b]	1330 ESE	3840 NNW	1860 WSW	2960 N	1230 SE	7890 ENE

See notes on page 11.

Table 2.1 Grouped Sources

Grouped Source	Control Device	Control Efficiency	Distance in Meters to the Nearest:					
			Resident	School	Office or Business	Farm		
						Veg.	Meat	Milk
X-705 Calciners (3)	Wet Scrubber	75%[d]	1330 ESE	4020 NNW	1800 W	3200 N	1050 ESE	7960 ENE
X-710 Laboratory Fume Hoods (39)	None	N/A	1260 E	4690 NNW	1660 WNW	3930 N	1130 E	8350 ENE
X-705 Decontamination Facility	One area HEPA Others none	99.97% N/A	1330 ESE	4020 NNW	1800 W	3200 N	1050 ESE	7960 ENE
X-705 Storage Tank Vents	None	N/A	1330 ESE	4020 NNW	1800 W	3200 N	1050 ESE	7960 ENE
X-700 Chemical Cleaning Building	HEPA Filters	99.97%	1220 ESE	3910 NNW	1910 W	3200 N	930 E	7840 ENE
X-720 Maintenance Facility	None	N/A	1220 E	4250 NNW	1800 W	3430 N	1010 E	7880 ENE
Room Air Exhausts	None	N/A	850 ESE	3410 NNW	1370 W	2680 N	760 SE	7560 ENE

See notes on page 11.

Notes to Tables in Section II

a The Top and Side Purge Cascade vent streams pass separately through activated alumina traps. A third line, the Emergency Jet, connects to both lines through block valves. All three lines have continuous samplers. The three vent lines connect to four exhaust pipes that extend above the 50-meter tower. The Top Purge jet is vented directly through one pipe. The Side Purge Jet and Emergency Jet lines are interconnected to the other three pipes.

b Chemical adsorbents (activated alumina) are approximately 95 percent effective at concentrations above 1 ppm. Below this concentration, chemical adsorbents have reduced efficiency or no effect. Normal concentrations entering the Purge Cascade Chemical Traps are near or below 1 ppm. The Sample Traps (which follow the control traps) use activated alumina hydrated to 14 percent moisture content, which is much more effective due to an instantaneous reaction of gaseous UF_6 and Tc with the water to form particulate matter.

c Based on process knowledge, cold traps are estimated to be approximately 90 to 95 percent effective in trapping gaseous UF_6.

d Scrubber efficiency is estimated to be approximately 75 percent but has not been rigorously measured. Normal emissions from source are estimated to be negligible compared to monitored sources (<0.001 curies of uranium).

Radionuclide Emissions from Point Sources During CY 1997

Mass emissions of uranium from the monitored emissions points increased from 7.50 kg to 45.0 kg and the activity level increased from 0.013 curie to 0.036 curie due to uranium emissions from the Area 1 Seal Exhaust Vent in the X-333 Process Building. Emissions from this vent have been reduced to their previous levels. Technetium emissions decreased from 37.0 g (0.641 curies) to 3.35 g (0.049 curies).

There were no unplanned releases during 1997.

Prior to 1995 PORTS, modeled its emissions as three co-located stacks, sited at the actual location of the predominate source, the purge cascade vent stack. The co-location of stacks was used due to the fact that the CAP-88 modeling program limits the number of vents/locations that can be modeled in each run. Stack 1 corresponded to the actual purge cascade vents (stack height equals 50 meters). Stack 2 (USEC) was a composite of all other process building vents (20 meters) and the X-344A vent (14 meters). Stack 3 (DOE) represented the X-345 HASA vent (3 meters).

Since 1995 USEC has modeled its emissions from PORTS as nine individual source locations. The 1995 report also included three sources for DOE. Attachment 1 lists 103 actual and potential emissions sources. Some of these would release radioactivity only as the result of an accident and, thus, are not normally release points. Emissions from 35 of the 103 sources were grouped into 9 pseudo sources for modeling purposes due to the impracticality and expense of modeling a large number of sources. See Table 2.2 for a description of the emission points for each modeled source.

In 1996, USEPA directed USEC and DOE to submit separate reports for their areas of responsibility. However, each entity was directed to included the other's dose assessment values in its report.

Table 2.2 Curies Released During CY 1997

NUCLIDE	Solu. Class	AMAD (μm)	Sources									
			1	2	3	4	5	6	7	8	9	Total
^{234}U	D	1	3.91E-03	1.52E-04	4.58E-04	1.56E-02	2.84E-05	4.37E-08	2.63E-02	1.22E-04	9.61E-06	4.66E-02
^{235}U	D	1	9.55E-05	4.29E-06	2.08E-05	9.56E-04	1.01E-06	1.51E-09	9.34E-04	3.67E-06	2.11E-07	2.02E-03
^{236}U	D	1	2.15E-07	6.44E-09	9.15E-08	2.77E-06	1.20E-09	2.59E-12	2.00E-05	1.94E-08	2.87E-09	2.31E-05
^{238}U	D	1	1.14E-04	6.00E-06	2.37E-04	1.44E-02	3.00E-06	3.12E-09	5.50E-04	9.41E-06	2.17E-07	1.53E-02
^{99}Tc	D	1	3.05E-02	3.42E-03	7.53E-03	6.09E-03	1.27E-03	0	4.48E-01	5.14E-09	0	4.97E-01
^{231}Th	W	1	9.55E-05	4.29E-06	2.08E-05	9.56E-04	1.01E-06	0	0	0	0	1.08E-03
^{234}Th	W	1	1.14E-04	6.00E-06	2.37E-04	1.44E-02	3.00E-06	0	0	0	0	1.48E-02
^{234m}Pa	W	1	1.14E-04	6.00E-06	2.37E-04	1.44E-02	3.00E-06	0	0	0	0	1.48E-02

Notes:

1. Source 1 is comprised of X-326 Top Purge Vent, Side Purge Vent and Emergency-Jet Vent.
2. Source 2 is comprised of X-326 Extended Range Product emissions, X-326 SE 6 Vent, X-326 SE 5 Vent and X-326 SE 4 Vent.
3. Source 3 is comprised of X-330 Building Cell Evacuation/Cold Recovery Vent, SE 3 Vent and SE 2 Vent.
4. Source 4 is comprised of X-333 Low Assay Withdrawal, Cold Recovery Vent, Building Wet Air Evacuation Vent, and SE 1 Vent.
5. Source 5 is comprised of emissions from the X-344 Gulper Vent.
6. Source 6 is comprised of X-700 only.
7. Source 7 is comprised of X-705 only.
8. Source 8 is comprised of X-710 only.
9. Source 9 is comprised of X-720 only.

Radionuclide Emissions from Fugitive and Diffuse Sources During CY 1997

There were no significant emissions of radionuclides from diffuse or fugitive sources at PORTS.

PORTS maintains a network of 27 (formerly 17) ambient air monitors at 15 locations (15 low volume and 12 high volume ambient air monitors) which continuously sample for particulate radionuclides. All gaseous radionuclides emitted from PORTS operations become particulates within a few feet of the emission point. Data from these monitors confirms that total plant emissions, including those from fugitive and diffuse sources, do not cause the public to receive an effective dose equivalent in excess of the standard of 10 mrem/yr (0.1 mSv).

The air monitors are divided into three groups: onsite, property line, and offsite. The property line monitors are used to confirm the dose to the public, and one of the offsite monitors is located in Piketon, which is the largest population center in the immediate vicinity of the plant. The onsite monitors are used to determine exposure to plant personnel. Between June 1993 and January 1995, PORTS installed high volume particulate samplers at each of the property line and offsite locations. In June of 1995, DOE transferred ownership and operational control of the ambient air monitoring network to USEC.

The filters from both the low-volume and high-volume samplers are analyzed for total alpha and total beta activity; the alpha is assumed to come from uranium and the beta from technetium. Data from both systems indicate that the units are measuring background levels of radiation.

SECTION III. DOSE ASSESSMENTS

Description of Dose Model

The radiation dose calculations were performed using the CAP-88 package of computer codes. This package contains EPA's most recent version of the AIRDOS-EPA computer code. This program implements a steady-state, Gaussian plume, atmospheric dispersion model to calculate environmental concentrations of released radionuclides. It also includes Regulatory Guide 1.109 food chain models to calculate human exposure, both internal and external, to radionuclides deposited in the environment. The human exposure values are then used by the EPA's latest version of the DARTAB computer code to calculate radiation dose to man from the radionuclides released during the year. The dose calculations use dose conversion factors in the latest version of the RADRISK data file, which is provided by the EPA with the CAP-88 package.

Summary of Input Parameters

Except for the radionuclide parameters given in Section II and those given below, all important input parameter values used are the default values provided with the CAP-88 computer codes and data bases.

Meteorological data:	1997 data from onsite tower
Rainfall rate:	116 cm/year (CY 1997)
Average air temperature:	11°C (CY 1997)
Average mixing layer height:	2000 meters

Fraction of foodstuffs from:	Local Area	Within 50 mi	Beyond 50 mi*
Vegetables and produce	0.700	0.300	0.000
Meat	0.442	0.558	0.000
Milk	0.399	0.601	0.000

*The dose estimate for foodstuffs is very conservative when 0.0 is used as an input parameter in the category of foodstuffs consumed that were produced at a distance of 50 miles or more from the PORTS site. Realistically, it can be assumed that very little of the foodstuffs consumed by residents within a 50-mile radius of PORTS are produced within 50 miles of the PORTS site. The majority of the foodstuffs consumed are purchased at supermarkets that receive foodstuffs from all over the world.

Source Characteristics

Source	Type	Release Height (m)	Inner Diameter (m)	Gas Exit Velocity (m/s)	Gas Exit Temperature (° C)	Distance to Nearest Individual (m)	Direction to Nearest Individual
1	Point	50	0.25	18.0	35.0	1370	SE
2	Point	20	0.97	24.0	35.0	1430	E
3	Point	20	0.20	61.0	35.0	1690	ESE
4	Point	20	0.62	29.0	35.0	1330	ESE
5	Point	20	0.36	0.3	23.8	1830	ESE
6	Point	16	0.30	14.0	23.8	1220	ESE
7	Point	14	1.50	12.3	26.7	1330	ESE
8	Point	9	1.00	10.2	26.7	1260	E
9	Point	18	1.19	9.0	23.8	1220	E

Compliance Assessment

The most exposed member of the public received an EDE of 0.12 mrem/yr (1.2×10^{-3} mSv/yr) from **USEC operations** as calculated by CAP88. **DOE operations** contributed an additional 5.46×10^{-3} mrem/yr (5.46×10^{-5} mSv/yr) to this individual's EDE for a total of 0.13 mrem/yr (1.3×10^{-3} mSv/yr) from **total plant operations**. This individual was located 1450 meters east of USEC's predominant emission source (the X-705 Decontamination Facility) and 2360 meters east northeast of DOE's predominant emissions source (the X-326 Glove Box). DOE used the CAP88PC model.

The EDE to the most exposed individual resulting from **DOE operations only** was 7.43×10^{-3} mrem/yr (7.43×10^{-5} mSv/yr) as determined using CAP88PC at a location 1750 meters east northeast of DOE's predominant emissions source (the X-326 Glove Box). This is **not** the same individual who received the maximum dose from USEC operations since the predominate emissions sources are in different locations. When the sources are combined, the most exposed individual from **total plant operations** is the same as that calculated for USEC operations alone.

SECTION IV. ADDITIONAL INFORMATION

New/Modified Sources Completed in 1997

No new facilities or modifications of existing facilities as defined under NESHAP regulations were initiated or completed at PORTS during 1997.

Unplanned Releases

There were no unplanned releases of uranium or technetium in 1997. Minor releases occurred during attaching and detaching of lines to cylinders or when cracks in lines developed. The practice of as low as reasonably achievable (ALARA) is used to shut down the building ventilation system to prevent the release from reaching the atmosphere. Therefore, PORTS feels that the small releases should be considered diffuse/fugitive emissions.

Diffuse/Fugitive Emissions

Diffuse/fugitive emissions include all emissions that do not pass through a discrete stack, vent, or pipe. Potential sources of diffuse and fugitive emissions at PORTS include normal building ventilation, soil excavation activities, and wastewater treatment facilities.

X-326 Shutdown/Cleanup Activities

Activities associated with the shutdown and cleanup of the X-326 process equipment which formerly produced highly enriched uranium and very highly enriched uranium were completed in the fall of 1996. All equipment was treated with fluorinating agents to vaporize the uranium deposits which vaporized the technetium deposits as well. The resulting material was fed into the cascade for recovery of the uranium. The equipment was buffered with dry air and was placed in long term storage pending plant decontamination and decommissioning.

Highly Enriched Uranium Refeed

Until late 1991, PORTS produced HEU (material having an assay greater than 20% ^{235}U) and VHE (material having an assay greater than 97% ^{235}U) for the US Navy. Following the suspension of production of HEU and VHE, material in excess of the Navy's needs remained in storage at PORTS. In mid 1995, DOE and USEC entered into an agreement whereby USEC would refeed that material and blend it down to levels suitable for use in commercial nuclear power reactors. The refeed project will continue until late 1998.

Collective EDE (Person-Rem/Yr) 50-mile Radius

The following table gives the 50-mile radius EDEs for the past eight years. The EDEs for the most exposed individual are given for comparison. The collective EDE for persons living in the village of Piketon (~1635 persons) is 0.06 person rem/yr.

Annual Doses Due to PORTS Airborne Emissions, 1990-1997[1]

	1990	1991	1992	1993	1994	1995	1996	1997	EPA Standard
EDE[2] (mrem/yr)	0.06	0.03	0.26	0.91	0.06	0.13	0.14	0.12	10
Collective EDE[3]	0.4	0.3	3	11.6	0.6	1.2	2.2	1.5	N/A

Notes:

1. EDE values through 1995 are for total plant operations; since 1996, figures are for USEC operations only.
2. EDE for most exposed individual (1450 Meters E of the X-705). The distance is from the predominate emissions source in 1997 which was the X-705 Decontamination Facility.
3. Collective EDE in person rem/yr for 50-mile radius. This is a summation of the dose to each individual living within a 50-mile radius.

SECTION V. SUPPLEMENTAL INFORMATION

Compliance with Subparts Q and T of 40 CFR 61

Subpart Q is not applicable to PORTS. PORTS does not manage any radium-containing sources as defined in NESHAP Subpart Q.

Subpart T is not applicable to PORTS. PORTS does not manage nor has it ever managed uranium mill tailings as defined in Subpart T or any comparable material.

^{220}Rn and ^{222}Rn Emissions

PORTS does not have and does not expect to have any ^{220}Rn emissions due to ^{232}U or ^{232}Th sources. PORTS does not manage any ^{232}U and consequently does not have any emissions of ^{220}Rn due to ^{232}U decay. Although PORTS does not specifically manage ^{232}Th, some amount must be present due to ^{236}U decay. ^{236}U is itself a trace component of the uranium managed at PORTS, and its thorium daughter is extremely long-lived (half-life greater than 14 billion years). These figures indicate that no measurable concentrations of ^{220}Rn due to ^{232}Th decay will exist onsite within any foreseeable future.

The uranium processed at PORTS has previously been chemically purified at the mill to remove all naturally occurring elements including ^{226}Ra, which is the precursor of ^{222}Rn. It has been calculated that 10,000 years would be required before detectable levels of ^{222}Rn would occur due to the natural decay process.

Compliance with NESHAP Subpart H Effluent Monitoring Requirements

PORTS (USEC) has continuous emissions monitors (samplers) on 13 point sources (stacks) of the 35 point/grouped sources that represent what are believed to be all of the significant emissions point sources at PORTS. Most of the continuously monitored point sources are not actually subject to the continuous monitoring requirement. PORTS believes that all 13 monitors comply with the requirements of 40 CFR 61.93(b) (i.e., they are equivalent to the EPA reference methods). Region V conducted a detailed inspection of the stack sampling program during its NESHAP inspection the week of March 15, 1993 and July 22, 1996. Although not explicitly stated in the final inspection report, Region V has apparently accepted the stack sampling methodology.

The final NESHAP inspection report did not address the frequency or the methodology for periodic confirmatory measurements. U.S. EPA has accepted engineering estimates in other regions, and PORTS is in the process of making estimates for all radionuclide sources using the methods found in 40 CFR 61, Appendices D and E. Stack tests for radionuclides were made on six sources in 1989, and repeat testing was conducted on one source in 1993 as part of the process for renewal of its state air permit.

PORTS included continuous ambient air monitoring in its compliance plan to provide continuous supporting evidence that no significant radionuclide emissions had been overlooked in the source monitoring program. USEC is currently performing the ambient air monitoring at PORTS and has obtained ownership of the compliance plan. PORTS believes that this plan is both more protective of the environment and human health and more cost effective than a largely hypothetical "evaluation" of all possible sources of essentially trivial amounts of radionuclides at three-year intervals. Ambient air monitoring appears to be the only feasible means for assessing emissions from fugitive and diffuse sources.

PORTS has conducted an extensive stack and vent survey. Stacks with a potential to emit radionuclides have been identified. Emissions from stacks and vents with the potential to emit radionuclides and other air pollutants are presently being evaluated. See Attachment 1 for a listing of the radionuclide stacks/vents at PORTS.

Attachment 1 PORTS 1997 Potential and Actual Radiological Emissions Point Sources
(To USEC Air Emissions Annual Report [Under Subpart H, 40 CFR 61.94] Calendar Year 1997).

STACK NUMBER	DESCRIPTION
X-326-A-512	Seal Exhaust Vent Area 4
X-326-A-540	Seal Exhaust Vent Area 6
X-326-A-528	Seal Exhaust Vent Area 5
X-326-B-284	ERP Withdrawal Room Vent
X-326-P-2798	S-Jet Exhaust - Purge Cascade
X-326-P-2799	T-Jet Exhaust - Purge Cascade
X-326-P-616	E-Jet Exhaust - Purge Cascade
X-330-A-079	Tails Withdrawal Room Exhaust
X-330-A-262	Seal Exhaust Vent Area 2
X-330-A-272	X-330 Cold Recovery/Building Wet Air Evacuation Vent
X-330-A-279	Seal Exhaust Vent Area 3
X-330-P-3020	X-330 Building Wet Air Evacuation System (Inactive)
X-333-A-832	Low Assay Withdrawal (LAW) Seal Exhaust Vent
X-333-A-851	Seal Exhaust Vent Area 1
X-333-A-852	X-333 Cold Recovery Vent
X-333-P-856	X-333 Building Wet Air Evacuation Vent
X-333-B-862	LAW Station Room Exhaust
X-342A-A-974	Autoclave Exhaust
X-343-B-1015	Exhaust Fan AJ 108
X-343-P-1011	Autoclave Air Ejector
X-343-P-964	Air Jet
X-343-P-997	Autoclave Housing Relief Vent
X-343-P-998	Autoclave Housing Relief Vent
X-343-P-999	Autoclave Housing Relief Vent
X-344-B-956	Room Air Over Maintenance Shops
X-344-P-929	Gulper Exhaust
X-344A-A-937	Air Ejector
X-700-A-1032	Large Parts Shot Blaster

STACK NUMBER	DESCRIPTION
X-700-A-1037	X-700 Rad Calibration Lab Fume Hood
X-700-A-1043	Converter repair Station
X-700-A-1053	Small Parts Glass Blaster
X-705-A-1348	Fume Hood
X-705-A-1426	X-705 Gulper System
X-705-A-2813	Small Cylinder Cleaning Unit
X-705-B-1369	Recovery Room Vent
X-705-B-1372	Uranium Solution Storage Vent
X-705-B-1379	Dissolver Storage Columns
X-705-B-1384	Compressor Dismantling Area
X-705-B-2810	Small Cylinder Pit Hood Exhaust
X-705-B-2811	Blue Room
X-705-B-2826	Complexing Hand Table Hood
X-705-B-3091	South Annex Exhaust
X-705-P-1353	X-705 "B" Loop Storage Slabs
X-705-P-1354	X-705"A" Loop Storage Slabs
X-705-P-1361	T-Water Storage Columns
X-705-P-1364	Bi Uranyl Nitrate Storage Column
X-705-P-1366	Heavy Metals Storage Columns
X-705-P-1375	Caustic Precipitation Handtable Exhaust
X-705-P-1377	Air Jet Recovery
X-705-P-1382	Alumina Filter Tables
X-705-P-1404	Tunnel Vent Fan
X-705-P-1406	Nitric Acid Booth
X-705-P-1422	X-705 Calciner Glove Box
X-705-P-1424	Uranium Sampling & Blending Glove Box
X-705-P-1950	X-705 North Spray Tank
X-705-P-1951	High Assay Parts Cleaning Tables
X-705-P-1952	Group I Hand Table

STACK NUMBER	DESCRIPTION
X-705-P-1953	Small Parts Pit Cleaning Area
X-705-P-1954	Handtable
X-705-P-1960	Ion Exchange Vent
X-710-B-1655	EF 101 Room 111 Lab Hood
X-710-B-1656	EF 122 Room 120 Lab Hood
X-710-B-1657	EF 102 Room 111 Lab Hood
X-710-B-1658	EF 103 Room 111 Lab Hood
X-710-B-1659	EF 123 Room 120 Lab Hood
X-710-B-1661	EF 104 Room 111 Lab Hood
X-710-B-1666	EF 124 Room 120 Lab Hood
X-710-B-1667	EF 106 Room 111 Lab Hood
X-710-B-1668	EF 107 Room 111 Lab Hood
X-710-B-1669	EF 125 Room 120 Lab Hood
X-710-B-1671	EF 108 Room 111 Lab Hood
X-710-B-1673	EF 112 Room 111 Lab Hood
X-710-B-1674	EF 109 Room 111 Lab Hood
X-710-B-1675	EF 126 Room 120 Lab Hood
X-710-B-1676	EF 110 Room 111 Lab Hood
X-710-B-1677	EF 111 Room 111 Lab Vent
X-710-B-1679	EF 127 Room 120 Lab Hood
X-710-B-1681	EF 113 Room 111 Lab Hood
X-710-B-1682	EF 128 Room 120 Lab Hood
X-710-B-1685	EF 114 Room 111 Lab Hood
X-710-B-1686	EF 115 Room 111 Lab Hood
X-710-B-1687	EF 129 Room 120 Lab Hood
X-710-B-1688	EF 116 Room 111 Lab Hood
X-710-B-1692	EF 6 Room 112 Room Vent
X-710-B-1693	EF 117B Room 111 Lab Hood
X-710-B-1694	EF 130 Room 120 Lab Hood

STACK NUMBER	DESCRIPTION
X-710-B-1696	EF 234 Room 240 Lab Hood
X-710-B-1697	EF 117A Room 111 Lab Hood
X-710-B-1698	EF 118 Room 111 Lab Hood
X-710-B-1701	EF 274 Room 240 Lab Hood
X-710-B-1703	EF 167 Room 114 Lab Hood
X-710-B-1706	EF 235 Room 240 Lab Hood
X-710-B-1707	EF 166 Room 114 Lab Hood
X-710-B-1710	EF 275 Room 241 Lab Hood
X-710-B-1711	EF 119 Room 114 Lab Hood
X-710-B-1719	EF 120 Room 115 Lab Hood
X-710-B-1724	EF 238 Room 243 Lab Hood
X-710-B-1732	EF 128 Room 115 Lab Hood
X-710-B-1733	EF 133 Room 128 Lab Hood
X-710-B-1744	EF 223 Room 229 Lab Hood
X-710-B-1747	EF 225 Room 229 Lab Hood
X-710-B-1749	EF 228 Room 229 Lab Hood
X-710-B-1750	EF 229 Room 229 Lab Hood
X-710-B-1751	EF 227 Room 229 Lab Hood
X-710-B-1753	EF 230 Room 229 Lab Hood
X-710-B-1757	EF 239 Room 243 Lab Hood
X-710-B-1758	EF 240 Room 243 Lab Hood
X-710-B-1759	EF 241 Room 243 Lab Hood
X-710-B-1761	EF 270 Room 238 Lab Hood
X-710-B-1779	EF 265 Room 285 Lab Hood
X-710-B-1789	EF 256 Room 263 Lab Hood
X-710-B-1803	EF 162 Room 157 Lab Hood
X-710-B-1805	EF 161 Room 142 Lab Hood
X-710-B-1808	EF 159 Room 156 Lab Hood
X-710-B-1810	EF 158 Room 156 Lab Hood

STACK NUMBER	DESCRIPTION
X-710-B-1811	EF 157 Room 156 Lab Hood
X-710-B-1814	EF 156 Room 156 Lab Hood
X-710-B-1821	EF 143 Room 138 Lab Hood
X-710-B-1822	EF 142 Room 138 Lab Hood
X-710-B-1823	EF 199 Room 138 Lab Hood (AA Unit, has HEPA filter)
X-710-B-1825	EF 141 Room 138 Lab Hood
X-710-B-1830	EF 140 Room 135 Lab Hood
X-710-B-1832	EF 139 Room 135 Lab Hood
X-710-B-1836	EF 138 Room 135 Lab Hood
X-710-B-1838	EF 137 Room 135 Lab Hood
X-710-B-1841	EF 136 Room 135 Lab Hood
X-710-B-1847	EF 134 Room 135 Lab Hood
X-710-B-1849	EF 135 Room 135 Lab Hood
X-720-A-1874	Grit Blasting Room
X-720-A-1545	Motor Shop Steam Cleaning Booth
X-720-A-1904	X-720 Burn Off Oven
X-720-B-1515	Sample Bottle Exhaust

Certification

I certify under penalty of law that I have personally examined and am familiar with the information submitted herein and based on my inquiry of those individuals immediately responsible for obtaining the information, I believe that the submitted information is true, accurate, and complete representation of the emissions under United States Enrichment Corporation control. I am aware that there are significant penalties for submitting false information including the possibility of fine and imprisonment (see 18 U.S.C. 1001).

Name: T. Michael Taimi
USEC Environmental Assurance and Policies Manager

Signature: T. Michael Taimi Date: 6/18/98

United States Enrichment Corporation (USEC)
Air Emissions Annual Report
(Under Subpart H, 40 CFR 61.94)
Calendar Year 1997

Site Name: Portsmouth Gaseous Diffusion Plant

Site Information

Operator: United States Enrichment Corporation

Address: Post Office Box 628
3930 U.S. Route 23 South
Piketon, Ohio 45661

Contact: T. Michael Taimi Phone: (301) 564-3409

Owner: U.S. Department of Energy
Portsmouth Site Office

SECTION I. FACILITY INFORMATION

SITE DESCRIPTION

The Portsmouth Gaseous Diffusion Plant (PORTS) is owned by the Department of Energy (DOE). PORTS was operated by DOE and managed by Martin Marietta Energy Systems, Inc. (now Lockheed Martin Utility Services, Inc.), until July 1, 1993. In 1992 Congress passed legislation amending the Atomic Energy Act of 1954 to create the United States Enrichment Corporation (USEC), a government corporation, to operate the uranium enrichment enterprise in the United States. The new corporation began operation on July 1, 1993. In accordance with the Act, USEC leased all production facilities at PORTS and its sister plant at Paducah, Kentucky, from DOE. DOE retained operational control of all waste storage and handling facilities as well as all sites undergoing environmental restoration.

The PORTS site is located in sparsely populated, rural Pike County, Ohio, on a 16.2-km^2 (6.3-$mile^2$) site about 1.6 km (1 mile) east of the Scioto River Valley at an elevation of approximately 36.6 m (120 ft) above the Scioto River floodplain. The terrain surrounding the plant, except for the Scioto River floodplain, consists of marginal farmland and densely forested hills. The Scioto River floodplain is farmed extensively, particularly with grain crops.

Pike County has a generally moderate climate. Winters in Pike County are moderately cold, and summers are moderately warm and humid. The precipitation is usually well distributed with fall being the driest season. Prevailing winds at the site are out of the southwest to south. Average wind speeds are about 5 mph (8 km/h) although winds of up to 75 mph (120 km/h) have been recorded at the plantsite. Usually, high winds are associated with thunderstorms that occur in spring and summer. Southern Ohio lies within the Midwestern tornado belt although no tornados have struck the plantsite to date.

Pike County has approximately 23,000 residents. Scattered rural development is typical; however, the county contains numerous small villages such as Piketon, Wakefield, and Jasper, which lie within a few kilometers of the plant. The county's largest community, Waverly, is about 19 km (12 miles) north of the plantsite and has a population of approximately 5,100 residents. Additional population centers within 80 km (50 miles) of the plant are Portsmouth (population 25,500), Chillicothe (population 23,420), and Jackson (population 6,675). The total population of the area lying within an 80-km (50-mile) radius of the plant is approximately 600,000.

USEC is responsible for the principal site process and support operations. The principal site process is the separation of uranium isotopes through gaseous diffusion. Support operations include the feed and withdrawal of material from the primary process, treatment of water for both potable and cooling purposes, steam generation for heating purposes, decontamination of equipment removed from the process for maintenance or replacement, recovery of uranium from various waste materials, and treatment of industrial wastes generated onsite. DOE is responsible for the X-326 "L-Cage" and its glovebox, the X-345 high assay sampling area (HASA), the X-744G glovebox, and site remediation activities. Because of the separation of responsibilities, DOE and USEC are submitting separate Annual NESHAP Reports and are certifying only those activities for which they have direct responsibility. Following is a description of USEC's emissions sources.

SOURCE DESCRIPTION

Radionuclides Used at the Facility

As discussed above, the principal site process is the separation of uranium isotopes. Large quantities of UF_6 are located on the site. UF_6 partially enriched in the ^{235}U isotope is received from the Paducah Gaseous Diffusion Plant located in Paducah, KY. This UF_6 also contains trace quantities of other radionuclides that came from DOE's practice during the years 1953 to 1975 of intermittently feeding reactor tails from government reactors in addition to the UF_6 typically used. The only radionuclide that is detectable in emissions from PORTS is technetium-99 (^{99}Tc). PORTS also uses a variety of sealed sources for calibration of equipment; however, none of these are released and therefore are not used in the determination of dose. Table 2.2 lists the radionuclides used in the determination of dose.

Monitored and Unmonitored Sources

The sources discussed in this section are the significant or potentially significant contributors to airborne radionuclide emissions due to USEC operations. These sources were grouped into 9 sources, each of which was then modeled using the CAP88 computer model.

In 1991, DOE ceased production of Highly Enriched Uranium (HEU) and Very Highly Enriched Uranium (VHE). Between October 1992 and October 1996, DOE removed the residual uranium from the part of the gaseous diffusion cascade that produced those materials and placed the equipment in long shutdown. The dose rose to its historic maximum of 0.91 mrem (0.0091 mSv) in 1993 due to unexpected emissions of technetium which were caused by cleanup activities associated with the shutdown. By 1996, the dose returned to more normal levels of approximately 0.1 mrem (0.001 mSv) per year. Section IV of this report contains a summary of the annual doses since 1990.

In 1995 PORTS began including emissions estimates from unmonitored sources (using the 40 CFR 61 Appendix D emissions factors) in the calculation of the EDE. Including the conservative estimates from those sources caused the calculated dose to double from the 1994 figure. The majority of the dose came from the X-326 Top Purge, Side Purge, E-jet vents and the X-705 Decontamination Facility. The majority of the dose from the X-326 Top Purge, Side Purge and E-jet vents was due primarily to technetium emissions. The majority of the dose from the X-705 Decontamination Facility was also due to technetium. Technetium emissions from the Cascade decreased from 0.641 curies in 1996 to 0.0475 curies in 1997. The judgement that no other significant sources exist at PORTS is supported by ambient air monitoring data. This data indicates the ambient airborne radionuclide concentrations are within standard modeling accuracy of the ambient concentrations predicted from the measured emissions of the 13 sources and emissions estimates from the remaining 22 sources.

PORTS determined that 13 of the radionuclide sources had the greatest potential for emissions and equipped them with continuous emissions monitors (samplers) (See Table 1.0). All 13 are continuously sampled by flow-proportional, isokinetic samplers to provide emissions data. Six of these sources (the purge cascades, the cold recovery systems, and the building wet air evacuation systems) are also monitored in real-time by ionization chamber instruments for operational control. The Continuous Emissions Monitors (samplers) are more sensitive, more accurate, and more reliable than the ionization chambers but cannot provide real-time data required for process control. The ionization chambers also provide early warning of upset conditions in the diffusion process.

Table 1.0 PORTS Continuously Monitored Emissions Points.

Location	Stack & Vent Identification Number
X-326 Top Purge Vent	X-326-P-2799
X-326 Side Purge Vent	X-326-P-2798
X-326 Emergency-Jet Vent	X-326-P-616
X-326 Seal Exhaust Vent 6	X-326-A-540
X-326 Seal Exhaust Vent 5	X-326-A-528
X-326 Seal Exhaust Vent 4	X-326-A-512
X-330 Seal Exhaust Vent 3	X-330-A-279
X-330 Seal Exhaust Vent 2	X-330-A-262
X-333 Seal Exhaust Vent 1	X-333-A-851
X-330 Cold Recovery/Building Wet Air Evacuation Vent	X-330-A-272
X-333 Cold Recovery Vent	X-333-P-852
X-333 Building Wet Air Evacuation Vent	X-333-P-856
X-344 Gulper Vent	X-344-P-929

MONITORED SOURCES

Top and Side Purge Cascades

The two purge cascades continuously separate light gases from process gas (UF_6) using gaseous diffusion. The separated process gas is returned to the main cascade from the tail of the purge cascades. The light gases are split at the head of the purge cascades with enough "lights" being recycled to the main cascade to maintain normal operating flows and the balance are vented through chemical adsorbent traps to the atmosphere. The Side Purge Cascade and Top Purge Cascade (Emergency jet vent is used to handle excess flow from either the Top or Side Purge Cascades) operate in series at the very head of the main cascade.

Continuous operation of the purge cascades is required for continued operation of the main process cascade. Consequently, the two purge cascades are exhausted by three interconnected air jet eductors. The third eductor is an operating spare for either or both regular eductors to an interconnected set of four exhaust pipes. The pipes extend up a 50-meter free-standing tower to remove the emissions from the building's wind wake.

Seal Exhaust Stations

The seal exhaust (SE) stations maintain a vacuum within cascade compressor shaft seals to prevent inleakage of wet air to the cascade. This vacuum is isolated from the compressor side of the seal by a buffer zone. Gases evacuated from the seals are pulled through chemical adsorbent traps by a bank of manifolded vacuum pumps and exhausted to the atmosphere through mist eliminators (for pump oil) and a roof vent.

There is one seal exhaust station in each of the cascade's six "areas," each is located adjacent to the: area control room. Area 1 includes the entire X-333 process building. This station was equipped with a continuous emission monitor (vent sampler) in late 1989, which confirmed that the emissions were not a significant contributor to plant radionuclide emissions.

Radionuclide emissions from the other five seal exhaust stations should be very low compared to the X-333 Area 1 Seal Exhaust Station during normal operation. To confirm this and to provide for the possibility of unplanned releases, continuous emissions monitors (samplers) were installed on these five vents in 1991 and began operation the first week of 1992.

Cold Recovery Systems

The cold recovery systems are intermittently-operated maintenance support systems used to prepare cascade equipment (cells) for internal maintenance. Process gas in cascade cells scheduled for maintenance is first evacuated to adjacent cascade cells to the extent practical. The cell is then sealed off and alternately purged with dry nitrogen and evacuated repeatedly. The evacuated gases pass through chilled cylinders called "cold traps" to solidify any residual process gas. The non-condensible nitrogen carrier is passed through chemical adsorbents for polishing and then is vented by an air jet educator to the atmosphere. Periodically, individual cold traps are valved off from the vent, and the trapped UF_6 is returned to the cascade by vaporization. There are two cold recovery systems operated at PORTS with one each in the X-330 and X-333 process buildings. In X-330, the cold recovery system shares a common vent and vent sampler with the building evacuation system.

Building Wet Air Evacuation Systems

The building wet air evacuation systems are intermittently-operated maintenance support systems used to prepare off-line cascade cells for return to service. The cell is sealed off and alternately purged with dry nitrogen and evacuated to remove all outside air and moisture from the cell. The evacuated gases are passed through chemical adsorbents to catch residual radionuclides (if any) and vented to the atmosphere by an air jet educator. There are two building wet air evacuation systems, one associated with each of the cold recovery systems described above. In X-330, the cold recovery and building wet air evacuation system share a common vent and sampler.

X-344A Manifold Evacuation/Gulper

The X-344A Toll Transfer Facility contains an automated sampling and transfer system for sampling the product and for filling customer cylinders with low assay UF_6. To avoid cross contamination between samples and to prevent emissions to the air, the sampling and transfer manifold is evacuated back to the diffusion cascade through a line to the X-342 Feed Vaporization and Fluorine Generation Building. In the event of a trace release occurring in spite of the purge and evacuate procedure, a "gulper" is mounted behind the manifold-to-cylinder connections. The gulper is simply a continuous vacuum nozzle, similar in principal to a lab hood, which draws any small releases from the room air into a filtration system. The filtration system has two filter banks, each consisting of a roughing filter followed by high efficiency particulate air (HEPA) filters and a centrifugal blower.

UNMONITORED AND POTENTIAL SOURCES

PORTS has several unmonitored minor and potential emission sources associated with USEC process support activities. Based on process knowledge and ambient monitoring data, none of these sources are believed to contribute significantly to plant radionuclide emissions under normal operations.

The minor sources, as the term is used at PORTS, have some trace radionuclides in their routine emissions but only in negligible amounts under normal operating conditions. The potential sources are primarily room ventilation exhausts and/or pressure relief vents from areas that have a potential for internal radionuclide release.

Since 1995, PORTS has included emissions estimates from unmonitored sources in the calculation of the EDE.

X-705 Decontamination Facility

Equipment that is removed from the PORTS cascade is sealed at the point of removal and transported to the X-705 Decontamination Facility. Small parts are cleaned in "hand tables" or spray tanks, while large parts are sent through the automated "tunnel." The hand tables consist of shallow acid baths (either nitric or citric depending on the metal to be cleaned) where metal parts are decontaminated by passive soaking. The hand tables have fume hoods over them to protect workers from acid fumes. The spray tanks are enclosed tanks where equipment can be spray cleaned remotely. Pressure relief vents are standard on such equipment. The tunnel is an enclosed series of "booths" that decontaminate large parts by spraying with decontamination solutions (acids and water rinses) as a small rail car carries the parts through the tunnel. The tunnel is ventilated to prevent a buildup of acid fumes. In all cases, radionuclides (uranium and technetium) are dissolved in the liquid phase and collected for recovery of the uranium. None of the radionuclides are volatilized by normal operations of these facilities and only trace radionuclides carried by entrained droplets would be expected.

X-705 Calciners

Decontamination solutions are treated to yield a concentrated aqueous solution of uranyl nitrate, which is converted into uranium oxide powder in one of three calciners located in the X-705 decontamination building. A calciner consists of an inclined heated tube with the uranyl nitrate solution entering at the top and air entering at the bottom. The uranium is first dried and then oxidized as it passes down the tube. The uranium oxide powder is collected directly in a five-inch diameter storage can at the lower end of the calciner tube. The gaseous stream leaves the upper end of the calciner and is exhausted through a scrubber for NO_x control. Uranium is recovered from the spent scrubber solution through a microfiltration process and the effluent is discharged to a National Pollutant Discharge Elimination System permitted outfall. Turbulence and flow rates through the calciners are controlled to minimize blowback of the uranium oxide. Any blowback that does occur is entrapped by the entering uranium solution.

X-705 Glove Boxes

The five-inch can that collects the uranium oxide powder from each calciner is housed in a glove box to prevent the loss of the material. In addition, there is a separate glove box which is used for sampling the material in the can. The gloveboxes have air locks for the entry and removal of work materials and are maintained under negative pressure during use. This negative pressure is produced by an exhaust fan drawing through a HEPA filter.

X-705 Storage Tank Vents

Uranium-bearing solutions awaiting treatment are stored in a manifold of five-inch diameter tanks inside the X-705 facility. All of these tanks are manifolded to a common pressure relief vent that has some potential to release radionuclides if the tanks are overfilled or overheated. Normal emissions should be zero since the stored liquids are quiescent, the dissolved radionuclides are non-volatile, and the vents are not open except during filling.

Emissions estimates from sources in the X-705 Decontamination Facility are included in the EDE calculations. Emissions from X-705 were modeled as a single source. The X-705 Facility was the predominant emissions source in 1997. The emissions from X-705 were estimated using the factors given in the Code of Federal Regulations, Title 40, Part 61, Appendix D and are extremely conservative.

Laboratory Fume Hoods

Laboratory analysis of process and other samples is performed in the PORTS on-site laboratory in accordance with standard laboratory practices. There are no emissions controls on the lab hoods used in these procedures. The hoods should not see any measurable radionuclide emissions during normal operation. Small amounts of technetium are partially volatilized by the analytical method approved by the Environmental Protection Agency under the Safe Drinking Water Act. There is also a possibility of a UF_6 sample container bursting during processing. This is an extremely rare occurrence, however, and cannot be regarded as normal operation as specified in the NESHAP regulations. Most laboratory fume hoods are located in the X-710 laboratory building. There are two fume hoods in the X-760 Chemical Engineering Building which operates as an adjunct to the X-710 Laboratory. These hoods are used to prepare environmental samples such as soil, water, air, and vegetation samples for analysis in the X-710 Laboratory. The level of radionuclides in these samples is extremely low as evidenced by the analytical results. The X-705 Decontamination Facility has a small laboratory which contains three fume hoods which are used to prepare samples and analyze materials being processed in the building.

Emissions estimates from two sources in the X-710 have been included in the calculations of the EDE. The emissions from the X-710 were modeled as a single source.

Room Air Exhausts

Several uranium handling areas within the plant buildings have some potential for releasing minute ($\leq$1 gram) amounts of UF_6 into the room air. Releases of this size are characterized as small releases (visually resembling a puff of cigarette smoke). However, it should not be implied that any size release is acceptable or overlooked by PORTS. Studies conducted in the early 1980s demonstrated that a release of one gram of UF_6 produces a much larger release (smoke cloud) than what is normally observed during the operations discussed here. Ventilation exhausts from, and worker protection within these areas, are controlled according to the probability of releases occurring. Standard policy in the event of a large internal release is to evacuate the area and remotely close down the local ventilation for confinement and later decontamination.

Material feed and withdrawal areas occasionally have small releases when disconnecting UF_6 containers from process piping. These areas include the X-342A Feed and Fluorine Generation Facility, the X-343 Feed Facility, the X-344 Toll Transfer Facility, the X-330 Tails Withdrawal Area, the X-333 Low Assay Withdrawal Area, and the X-326 Extended Range Product and X-326 Product Withdrawal Area. These areas have dedicated ventilation exhausts for worker protection but no emission controls. There are no Continuous Emission Monitors ("environmental" vent samplers) on these exhausts. The plant's Health Physics (HP) Department continuously samples the air inside these areas for worker protection. The HP data indicates the average radionuclide concentrations inside the room are typically equivalent to natural background and, based on this, emissions from the room can be presumed to be environmentally insignificant.

The highest probability of internal releases besides the X-344A Sampling/Transfer Area, which was discussed in the previous section, is in the X-705 Decontamination Facility South Annex , where contaminated equipment is unsealed and disassembled. The South Annex has a separate HEPA filtered ventilation system and operates as a sealed area. Supplied air respirators are mandated for worker protection within the annex when the facility is in use. Normal emissions to the outside air should be negligible, which is consistent with ambient monitoring performed by the plant's HP and Environmental Departments in the past.

The "cell floors" of the process buildings are subject to a lesser potential for unplanned releases when cascade components are being serviced or removed. Special worker protection ventilation systems for the cell floors are not considered necessary for several reasons, including the huge volume of air passing through the general ventilation systems (approximately 4,000 process motors are air cooled by the general ventilation system) and the lower potential for a release. The cell floor air is continuously sampled by the HP Department. The same results found in the material withdrawal areas are seen on the cell floor. Routine emissions levels from process building ventilation should be equal to natural background levels. Plant procedure in the event of an unplanned release larger than a "small release" is to close the building ventilation system to confine the uranium for decontamination and recovery.

SECTION II. AIR EMISSIONS DATA

Tables 2.0 and 2.1 summarize the control device information for each source and give the distance and direction from each source to the nearest, resident, school, office or business, and farm producing vegetables, meat, and milk.

Table 2.0 Point Sources

Point Source	Control Device	Control Efficiency	Distance in meters to the Nearest:					
			Resident	School	Office or Business	Farm		
						Veg.	Meat	Milk
X-326 Top, Side Purge & E-jet (Cascades) (3 monitors)[a]	Chemical Adsorbents	0-95%[b]	1370 SE	5000 NNW	1520 SSE	4290 N	1370 E	8660 ENE
X-330 Cold Recovery/Wet Air Evacuation Vent	Cold Traps Chemical Adsorbents	90-95%[c] 0-95%[b]	1690 ESE	3930 NNW	1370 W	3200 N	1520 ESE, W	8380 ENE
X-333 Cold Recovery Vent	Cold Traps Chemical Adsorbents	90-95%[c] 0-95%[b]	1330 ESE	3840 NNW	1860 WSW	2960 N	1230 SE	7890 ENE
X-333 Wet Air Evacuation Vent	Chemical Adsorbents	0-95%[b]	1330 ESE	3840 NNW	1860 WSW	2960 N	1230 SE	7890 ENE
X-344A Manifold Evacuation/Gulper	HEPA Filters	99.97%	1830 ESE	3410 NNW	1460 WSW	2680 N	1830 SSE	8320 ENE

See notes on page 11.

Table 2.0 Point Sources, Continued

Point Source	Control Device	Control Efficiency	Distance in meters to the Nearest:					
			Resident	School	Office or Business	Farm		
						Veg.	Meat	Milk
X-326 Seal Exhaust Area 4	Chemical Adsorbents	0-95%[b]	1500 ESE	4420 NNW	1460 WNW	3720 N	1340 E	8470 ENE
X-326 Seal Exhaust Area 5	Chemical Adsorbents	0-95%[b]	1460 E	4630 NNW	1540 WNW	3940 N	1340 E	5830 ENE
X-326 Seal Exhaust Area 6	Chemical Adsorbents	0-95%[b]	1430 E	4880 NNW	1620 SSE	4180 N	1340 E	8630 ENE
X-330 Seal Exhaust Area 2	Chemical Adsorbents	0-95%[b]	1725 ESE	3690 NNW	1430 WSW	3020 N	1580 SE, W	8320 ENE
X-330 Seal Exhaust Area 3	Chemical Adsorbents	0-95%[b]	1620 E	4080 NNW	1400 W	3360 N	1430 E	8400 ENE
X-333 Seal Exhaust Area 1	Chemical Adsorbents	0-95%[b]	1330 ESE	3840 NNW	1860 WSW	2960 N	1230 SE	7890 ENE

See notes on page 11.

Table 2.1 Grouped Sources

Grouped Source	Control Device	Control Efficiency	Distance in Meters to the Nearest:					
			Resident	School	Office or Business	Farm		
						Veg.	Meat	Milk
X-705 Calciners (3)	Wet Scrubber	75%[d]	1330 ESE	4020 NNW	1800 W	3200 N	1050 ESE	7960 ENE
X-710 Laboratory Fume Hoods (39)	None	N/A	1260 E	4690 NNW	1660 WNW	3930 N	1130 E	8350 ENE
X-705 Decontamination Facility	One area HEPA Others none	99.97% N/A	1330 ESE	4020 NNW	1800 W	3200 N	1050 ESE	7960 ENE
X-705 Storage Tank Vents	None	N/A	1330 ESE	4020 NNW	1800 W	3200 N	1050 ESE	7960 ENE
X-700 Chemical Cleaning Building	HEPA Filters	99.97%	1220 ESE	3910 NNW	1910 W	3200 N	930 E	7840 ENE
X-720 Maintenance Facility	None	N/A	1220 E	4250 NNW	1800 W	3430 N	1010 E	7880 ENE
Room Air Exhausts	None	N/A	850 ESE	3410 NNW	1370 W	2680 N	760 SE	7560 ENE

See notes on page 11.

Notes to Tables in Section II

a The Top and Side Purge Cascade vent streams pass separately through activated alumina traps. A third line, the Emergency Jet, connects to both lines through block valves. All three lines have continuous samplers. The three vent lines connect to four exhaust pipes that extend above the 50-meter tower. The Top Purge jet is vented directly through one pipe. The Side Purge Jet and Emergency Jet lines are interconnected to the other three pipes.

b Chemical adsorbents (activated alumina) are approximately 95 percent effective at concentrations above 1 ppm. Below this concentration, chemical adsorbents have reduced efficiency or no effect. Normal concentrations entering the Purge Cascade Chemical Traps are near or below 1 ppm. The Sample Traps (which follow the control traps) use activated alumina hydrated to 14 percent moisture content, which is much more effective due to an instantaneous reaction of gaseous UF_6 and Tc with the water to form particulate matter.

c Based on process knowledge, cold traps are estimated to be approximately 90 to 95 percent effective in trapping gaseous UF_6.

d Scrubber efficiency is estimated to be approximately 75 percent but has not been rigorously measured. Normal emissions from source are estimated to be negligible compared to monitored sources ($<$0.001 curies of uranium).

Radionuclide Emissions from Point Sources During CY 1997

Mass emissions of uranium from the monitored emissions points increased from 7.50 kg to 45.0 kg and the activity level increased from 0.013 curie to 0.036 curie due to uranium emissions from the Area 1 Seal Exhaust Vent in the X-333 Process Building. Emissions from this vent have been reduced to their previous levels. Technetium emissions decreased from 37.0 g (0.641 curies) to 3.35 g (0.049 curies).

There were no unplanned releases during 1997.

Prior to 1995 PORTS, modeled its emissions as three co-located stacks, sited at the actual location of the predominate source, the purge cascade vent stack. The co-location of stacks was used due to the fact that the CAP-88 modeling program limits the number of vents/locations that can be modeled in each run. Stack 1 corresponded to the actual purge cascade vents (stack height equals 50 meters). Stack 2 (USEC) was a composite of all other process building vents (20 meters) and the X-344A vent (14 meters). Stack 3 (DOE) represented the X-345 HASA vent (3 meters).

Since 1995 USEC has modeled its emissions from PORTS as nine individual source locations. The 1995 report also included three sources for DOE. Attachment 1 lists 103 actual and potential emissions sources. Some of these would release radioactivity only as the result of an accident and, thus, are not normally release points. Emissions from 35 of the 103 sources were grouped into 9 pseudo sources for modeling purposes due to the impracticality and expense of modeling a large number of sources. See Table 2.2 for a description of the emission points for each modeled source.

In 1996, USEPA directed USEC and DOE to submit separate reports for their areas of responsibility. However, each entity was directed to included the other's dose assessment values in its report.

Table 2.2 Curies Released During CY 1997

NUCLIDE	Solu. Class	AMAD (μm)	Sources									
			1	2	3	4	5	6	7	8	9	Total
^{234}U	D	1	3.91E-03	1.52E-04	4.58E-04	1.56E-02	2.84E-05	4.37E-08	2.63E-02	1.22E-04	9.61E-06	4.66E-02
^{235}U	D	1	9.55E-05	4.29E-06	2.08E-05	9.56E-04	1.01E-06	1.51E-09	9.34E-04	3.67E-06	2.11E-07	2.02E-03
^{236}U	D	1	2.15E-07	6.44E-09	9.15E-08	2.77E-06	1.20E-09	2.59E-12	2.00E-05	1.94E-08	2.87E-09	2.31E-05
^{238}U	D	1	1.14E-04	6.00E-06	2.37E-04	1.44E-02	3.00E-06	3.12E-09	5.50E-04	9.41E-06	2.17E-07	1.53E-02
^{99}Tc	D	1	3.05E-02	3.42E-03	7.53E-03	6.09E-03	1.27E-03	0	4.48E-01	5.14E-09	0	4.97E-01
^{231}Th	W	1	9.55E-05	4.29E-06	2.08E-05	9.56E-04	1.01E-06	0	0	0	0	1.08E-03
^{234}Th	W	1	1.14E-04	6.00E-06	2.37E-04	1.44E-02	3.00E-06	0	0	0	0	1.48E-02
^{234m}Pa	W	1	1.14E-04	6.00E-06	2.37E-04	1.44E-02	3.00E-06	0	0	0	0	1.48E-02

Notes:

1. Source 1 is comprised of X-326 Top Purge Vent, Side Purge Vent and Emergency-Jet Vent.
2. Source 2 is comprised of X-326 Extended Range Product emissions, X-326 SE 6 Vent, X-326 SE 5 Vent and X-326 SE 4 Vent.
3. Source 3 is comprised of X-330 Building Cell Evacuation/Cold Recovery Vent, SE 3 Vent and SE 2 Vent.
4. Source 4 is comprised of X-333 Low Assay Withdrawal, Cold Recovery Vent, Building Wet Air Evacuation Vent, and SE 1 Vent.
5. Source 5 is comprised of emissions from the X-344 Gulper Vent.
6. Source 6 is comprised of X-700 only.
7. Source 7 is comprised of X-705 only.
8. Source 8 is comprised of X-710 only.
9. Source 9 is comprised of X-720 only.

Radionuclide Emissions from Fugitive and Diffuse Sources During CY 1997

There were no significant emissions of radionuclides from diffuse or fugitive sources at PORTS.

PORTS maintains a network of 27 (formerly 17) ambient air monitors at 15 locations (15 low volume and 12 high volume ambient air monitors) which continuously sample for particulate radionuclides. All gaseous radionuclides emitted from PORTS operations become particulates within a few feet of the emission point. Data from these monitors confirms that total plant emissions, including those from fugitive and diffuse sources, do not cause the public to receive an effective dose equivalent in excess of the standard of 10 mrem/yr (0.1 mSv).

The air monitors are divided into three groups: onsite, property line, and offsite. The property line monitors are used to confirm the dose to the public, and one of the offsite monitors is located in Piketon, which is the largest population center in the immediate vicinity of the plant. The onsite monitors are used to determine exposure to plant personnel. Between June 1993 and January 1995, PORTS installed high volume particulate samplers at each of the property line and offsite locations. In June of 1995, DOE transferred ownership and operational control of the ambient air monitoring network to USEC.

The filters from both the low-volume and high-volume samplers are analyzed for total alpha and total beta activity; the alpha is assumed to come from uranium and the beta from technetium. Data from both systems indicate that the units are measuring background levels of radiation.

SECTION III. DOSE ASSESSMENTS

Description of Dose Model

The radiation dose calculations were performed using the CAP-88 package of computer codes. This package contains EPA's most recent version of the AIRDOS-EPA computer code. This program implements a steady-state, Gaussian plume, atmospheric dispersion model to calculate environmental concentrations of released radionuclides. It also includes Regulatory Guide 1.109 food chain models to calculate human exposure, both internal and external, to radionuclides deposited in the environment. The human exposure values are then used by the EPA's latest version of the DARTAB computer code to calculate radiation dose to man from the radionuclides released during the year. The dose calculations use dose conversion factors in the latest version of the RADRISK data file, which is provided by the EPA with the CAP-88 package.

Summary of Input Parameters

Except for the radionuclide parameters given in Section II and those given below, all important input parameter values used are the default values provided with the CAP-88 computer codes and data bases.

Meteorological data:	1997 data from onsite tower
Rainfall rate:	116 cm/year (CY 1997)
Average air temperature:	11°C (CY 1997)
Average mixing layer height:	2000 meters

Fraction of foodstuffs from:	Local Area	Within 50 mi	Beyond 50 mi*
Vegetables and produce	0.700	0.300	0.000
Meat	0.442	0.558	0.000
Milk	0.399	0.601	0.000

*The dose estimate for foodstuffs is very conservative when 0.0 is used as an input parameter in the category of foodstuffs consumed that were produced at a distance of 50 miles or more from the PORTS site. Realistically, it can be assumed that very little of the foodstuffs consumed by residents within a 50-mile radius of PORTS are produced within 50 miles of the PORTS site. The majority of the foodstuffs consumed are purchased at supermarkets that receive foodstuffs from all over the world.

Source Characteristics

Source	Type	Release Height (m)	Inner Diameter (m)	Gas Exit Velocity (m/s)	Gas Exit Temperature (° C)	Distance to Nearest Individual (m)	Direction to Nearest Individual
1	Point	50	0.25	18.0	35.0	1370	SE
2	Point	20	0.97	24.0	35.0	1430	E
3	Point	20	0.20	61.0	35.0	1690	ESE
4	Point	20	0.62	29.0	35.0	1330	ESE
5	Point	20	0.36	0.3	23.8	1830	ESE
6	Point	16	0.30	14.0	23.8	1220	ESE
7	Point	14	1.50	12.3	26.7	1330	ESE
8	Point	9	1.00	10.2	26.7	1260	E
9	Point	18	1.19	9.0	23.8	1220	E

Compliance Assessment

The most exposed member of the public received an EDE of 0.12 mrem/yr (1.2×10^{-3} mSv/yr) from **USEC operations** as calculated by CAP88. **DOE operations** contributed an additional 5.46×10^{-3} mrem/yr (5.46×10^{-5} mSv/yr) to this individual's EDE for a total of 0.13 mrem/yr (1.3×10^{-3} mSv/yr) from **total plant operations**. This individual was located 1450 meters east of USEC's predominant emission source (the X-705 Decontamination Facility) and 2360 meters east northeast of DOE's predominant emissions source (the X-326 Glove Box). DOE used the CAP88PC model.

The EDE to the most exposed individual resulting from **DOE operations only** was 7.43×10^{-3} mrem/yr (7.43×10^{-5} mSv/yr) as determined using CAP88PC at a location 1750 meters east northeast of DOE's predominant emissions source (the X-326 Glove Box). This is **not** the same individual who received the maximum dose from USEC operations since the predominate emissions sources are in different locations. When the sources are combined, the most exposed individual from **total plant operations** is the same as that calculated for USEC operations alone.

SECTION IV. ADDITIONAL INFORMATION

New/Modified Sources Completed in 1997

No new facilities or modifications of existing facilities as defined under NESHAP regulations were initiated or completed at PORTS during 1997.

Unplanned Releases

There were no unplanned releases of uranium or technetium in 1997. Minor releases occurred during attaching and detaching of lines to cylinders or when cracks in lines developed. The practice of as low as reasonably achievable (ALARA) is used to shut down the building ventilation system to prevent the release from reaching the atmosphere. Therefore, PORTS feels that the small releases should be considered diffuse/fugitive emissions.

Diffuse/Fugitive Emissions

Diffuse/fugitive emissions include all emissions that do not pass through a discrete stack, vent, or pipe. Potential sources of diffuse and fugitive emissions at PORTS include normal building ventilation, soil excavation activities, and wastewater treatment facilities.

X-326 Shutdown/Cleanup Activities

Activities associated with the shutdown and cleanup of the X-326 process equipment which formerly produced highly enriched uranium and very highly enriched uranium were completed in the fall of 1996. All equipment was treated with fluorinating agents to vaporize the uranium deposits which vaporized the technetium deposits as well. The resulting material was fed into the cascade for recovery of the uranium. The equipment was buffered with dry air and was placed in long term storage pending plant decontamination and decommissioning.

Highly Enriched Uranium Refeed

Until late 1991, PORTS produced HEU (material having an assay greater than 20% ^{235}U) and VHE (material having an assay greater than 97% ^{235}U) for the US Navy. Following the suspension of production of HEU and VHE, material in excess of the Navy's needs remained in storage at PORTS. In mid 1995, DOE and USEC entered into an agreement whereby USEC would refeed that material and blend it down to levels suitable for use in commercial nuclear power reactors. The refeed project will continue until late 1998.

Collective EDE (Person-Rem/Yr) 50-mile Radius

The following table gives the 50-mile radius EDEs for the past eight years. The EDEs for the most exposed individual are given for comparison. The collective EDE for persons living in the village of Piketon (~1635 persons) is 0.06 person rem/yr.

Annual Doses Due to PORTS Airborne Emissions, 1990-1997[1]

	1990	1991	1992	1993	1994	1995	1996	1997	EPA Standard
EDE[2] (mrem/yr)	0.06	0.03	0.26	0.91	0.06	0.13	0.14	0.12	10
Collective EDE[3]	0.4	0.3	3	11.6	0.6	1.2	2.2	1.5	N/A

Notes:

1. EDE values through 1995 are for total plant operations; since 1996, figures are for USEC operations only.
2. EDE for most exposed individual (1450 Meters E of the X-705). The distance is from the predominate emissions source in 1997 which was the X-705 Decontamination Facility.
3. Collective EDE in person rem/yr for 50-mile radius. This is a summation of the dose to each individual living within a 50-mile radius.

SECTION V. SUPPLEMENTAL INFORMATION

Compliance with Subparts Q and T of 40 CFR 61

Subpart Q is not applicable to PORTS. PORTS does not manage any radium-containing sources as defined in NESHAP Subpart Q.

Subpart T is not applicable to PORTS. PORTS does not manage nor has it ever managed uranium mill tailings as defined in Subpart T or any comparable material.

^{220}Rn and ^{222}Rn Emissions

PORTS does not have and does not expect to have any ^{220}Rn emissions due to ^{232}U or ^{232}Th sources. PORTS does not manage any ^{232}U and consequently does not have any emissions of ^{220}Rn due to ^{232}U decay. Although PORTS does not specifically manage ^{232}Th, some amount must be present due to ^{236}U decay. ^{236}U is itself a trace component of the uranium managed at PORTS, and its thorium daughter is extremely long-lived (half-life greater than 14 billion years). These figures indicate that no measurable concentrations of ^{220}Rn due to ^{232}Th decay will exist onsite within any foreseeable future.

The uranium processed at PORTS has previously been chemically purified at the mill to remove all naturally occurring elements including ^{226}Ra, which is the precursor of ^{222}Rn. It has been calculated that 10,000 years would be required before detectable levels of ^{222}Rn would occur due to the natural decay process.

Compliance with NESHAP Subpart H Effluent Monitoring Requirements

PORTS (USEC) has continuous emissions monitors (samplers) on 13 point sources (stacks) of the 35 point/grouped sources that represent what are believed to be all of the significant emissions point sources at PORTS. Most of the continuously monitored point sources are not actually subject to the continuous monitoring requirement. PORTS believes that all 13 monitors comply with the requirements of 40 CFR 61.93(b) (i.e., they are equivalent to the EPA reference methods). Region V conducted a detailed inspection of the stack sampling program during its NESHAP inspection the week of March 15, 1993 and July 22, 1996. Although not explicitly stated in the final inspection report, Region V has apparently accepted the stack sampling methodology.

The final NESHAP inspection report did not address the frequency or the methodology for periodic confirmatory measurements. U.S. EPA has accepted engineering estimates in other regions, and PORTS is in the process of making estimates for all radionuclide sources using the methods found in 40 CFR 61, Appendices D and E. Stack tests for radionuclides were made on six sources in 1989, and repeat testing was conducted on one source in 1993 as part of the process for renewal of its state air permit.

PORTS included continuous ambient air monitoring in its compliance plan to provide continuous supporting evidence that no significant radionuclide emissions had been overlooked in the source monitoring program. USEC is currently performing the ambient air monitoring at PORTS and has obtained ownership of the compliance plan. PORTS believes that this plan is both more protective of the environment and human health and more cost effective than a largely hypothetical "evaluation" of all possible sources of essentially trivial amounts of radionuclides at three-year intervals. Ambient air monitoring appears to be the only feasible means for assessing emissions from fugitive and diffuse sources.

PORTS has conducted an extensive stack and vent survey. Stacks with a potential to emit radionuclides have been identified. Emissions from stacks and vents with the potential to emit radionuclides and other air pollutants are presently being evaluated. See Attachment 1 for a listing of the radionuclide stacks/vents at PORTS.

Attachment 1 PORTS 1997 Potential and Actual Radiological Emissions Point Sources
(To USEC Air Emissions Annual Report [Under Subpart H, 40 CFR 61.94] Calendar Year 1997).

STACK NUMBER	DESCRIPTION
X-326-A-512	Seal Exhaust Vent Area 4
X-326-A-540	Seal Exhaust Vent Area 6
X-326-A-528	Seal Exhaust Vent Area 5
X-326-B-284	ERP Withdrawal Room Vent
X-326-P-2798	S-Jet Exhaust - Purge Cascade
X-326-P-2799	T-Jet Exhaust - Purge Cascade
X-326-P-616	E-Jet Exhaust - Purge Cascade
X-330-A-079	Tails Withdrawal Room Exhaust
X-330-A-262	Seal Exhaust Vent Area 2
X-330-A-272	X-330 Cold Recovery/Building Wet Air Evacuation Vent
X-330-A-279	Seal Exhaust Vent Area 3
X-330-P-3020	X-330 Building Wet Air Evacuation System (Inactive)
X-333-A-832	Low Assay Withdrawal (LAW) Seal Exhaust Vent
X-333-A-851	Seal Exhaust Vent Area 1
X-333-A-852	X-333 Cold Recovery Vent
X-333-P-856	X-333 Building Wet Air Evacuation Vent
X-333-B-862	LAW Station Room Exhaust
X-342A-A-974	Autoclave Exhaust
X-343-B-1015	Exhaust Fan AJ 108
X-343-P-1011	Autoclave Air Ejector
X-343-P-964	Air Jet
X-343-P-997	Autoclave Housing Relief Vent
X-343-P-998	Autoclave Housing Relief Vent
X-343-P-999	Autoclave Housing Relief Vent
X-344-B-956	Room Air Over Maintenance Shops
X-344-P-929	Gulper Exhaust
X-344A-A-937	Air Ejector
X-700-A-1032	Large Parts Shot Blaster

STACK NUMBER	DESCRIPTION
X-700-A-1037	X-700 Rad Calibration Lab Fume Hood
X-700-A-1043	Converter repair Station
X-700-A-1053	Small Parts Glass Blaster
X-705-A-1348	Fume Hood
X-705-A-1426	X-705 Gulper System
X-705-A-2813	Small Cylinder Cleaning Unit
X-705-B-1369	Recovery Room Vent
X-705-B-1372	Uranium Solution Storage Vent
X-705-B-1379	Dissolver Storage Columns
X-705-B-1384	Compressor Dismantling Area
X-705-B-2810	Small Cylinder Pit Hood Exhaust
X-705-B-2811	Blue Room
X-705-B-2826	Complexing Hand Table Hood
X-705-B-3091	South Annex Exhaust
X-705-P-1353	X-705 "B" Loop Storage Slabs
X-705-P-1354	X-705"A" Loop Storage Slabs
X-705-P-1361	T-Water Storage Columns
X-705-P-1364	Bi Uranyl Nitrate Storage Column
X-705-P-1366	Heavy Metals Storage Columns
X-705-P-1375	Caustic Precipitation Handtable Exhaust
X-705-P-1377	Air Jet Recovery
X-705-P-1382	Alumina Filter Tables
X-705-P-1404	Tunnel Vent Fan
X-705-P-1406	Nitric Acid Booth
X-705-P-1422	X-705 Calciner Glove Box
X-705-P-1424	Uranium Sampling & Blending Glove Box
X-705-P-1950	X-705 North Spray Tank
X-705-P-1951	High Assay Parts Cleaning Tables
X-705-P-1952	Group I Hand Table

STACK NUMBER	DESCRIPTION
X-705-P-1953	Small Parts Pit Cleaning Area
X-705-P-1954	Handtable
X-705-P-1960	Ion Exchange Vent
X-710-B-1655	EF 101 Room 111 Lab Hood
X-710-B-1656	EF 122 Room 120 Lab Hood
X-710-B-1657	EF 102 Room 111 Lab Hood
X-710-B-1658	EF 103 Room 111 Lab Hood
X-710-B-1659	EF 123 Room 120 Lab Hood
X-710-B-1661	EF 104 Room 111 Lab Hood
X-710-B-1666	EF 124 Room 120 Lab Hood
X-710-B-1667	EF 106 Room 111 Lab Hood
X-710-B-1668	EF 107 Room 111 Lab Hood
X-710-B-1669	EF 125 Room 120 Lab Hood
X-710-B-1671	EF 108 Room 111 Lab Hood
X-710-B-1673	EF 112 Room 111 Lab Hood
X-710-B-1674	EF 109 Room 111 Lab Hood
X-710-B-1675	EF 126 Room 120 Lab Hood
X-710-B-1676	EF 110 Room 111 Lab Hood
X-710-B-1677	EF 111 Room 111 Lab Vent
X-710-B-1679	EF 127 Room 120 Lab Hood
X-710-B-1681	EF 113 Room 111 Lab Hood
X-710-B-1682	EF 128 Room 120 Lab Hood
X-710-B-1685	EF 114 Room 111 Lab Hood
X-710-B-1686	EF 115 Room 111 Lab Hood
X-710-B-1687	EF 129 Room 120 Lab Hood
X-710-B-1688	EF 116 Room 111 Lab Hood
X-710-B-1692	EF 6 Room 112 Room Vent
X-710-B-1693	EF 117B Room 111 Lab Hood
X-710-B-1694	EF 130 Room 120 Lab Hood

STACK NUMBER	DESCRIPTION
X-710-B-1696	EF 234 Room 240 Lab Hood
X-710-B-1697	EF 117A Room 111 Lab Hood
X-710-B-1698	EF 118 Room 111 Lab Hood
X-710-B-1701	EF 274 Room 240 Lab Hood
X-710-B-1703	EF 167 Room 114 Lab Hood
X-710-B-1706	EF 235 Room 240 Lab Hood
X-710-B-1707	EF 166 Room 114 Lab Hood
X-710-B-1710	EF 275 Room 241 Lab Hood
X-710-B-1711	EF 119 Room 114 Lab Hood
X-710-B-1719	EF 120 Room 115 Lab Hood
X-710-B-1724	EF 238 Room 243 Lab Hood
X-710-B-1732	EF 128 Room 115 Lab Hood
X-710-B-1733	EF 133 Room 128 Lab Hood
X-710-B-1744	EF 223 Room 229 Lab Hood
X-710-B-1747	EF 225 Room 229 Lab Hood
X-710-B-1749	EF 228 Room 229 Lab Hood
X-710-B-1750	EF 229 Room 229 Lab Hood
X-710-B-1751	EF 227 Room 229 Lab Hood
X-710-B-1753	EF 230 Room 229 Lab Hood
X-710-B-1757	EF 239 Room 243 Lab Hood
X-710-B-1758	EF 240 Room 243 Lab Hood
X-710-B-1759	EF 241 Room 243 Lab Hood
X-710-B-1761	EF 270 Room 238 Lab Hood
X-710-B-1779	EF 265 Room 285 Lab Hood
X-710-B-1789	EF 256 Room 263 Lab Hood
X-710-B-1803	EF 162 Room 157 Lab Hood
X-710-B-1805	EF 161 Room 142 Lab Hood
X-710-B-1808	EF 159 Room 156 Lab Hood
X-710-B-1810	EF 158 Room 156 Lab Hood

STACK NUMBER	DESCRIPTION
X-710-B-1811	EF 157 Room 156 Lab Hood
X-710-B-1814	EF 156 Room 156 Lab Hood
X-710-B-1821	EF 143 Room 138 Lab Hood
X-710-B-1822	EF 142 Room 138 Lab Hood
X-710-B-1823	EF 199 Room 138 Lab Hood (AA Unit, has HEPA filter)
X-710-B-1825	EF 141 Room 138 Lab Hood
X-710-B-1830	EF 140 Room 135 Lab Hood
X-710-B-1832	EF 139 Room 135 Lab Hood
X-710-B-1836	EF 138 Room 135 Lab Hood
X-710-B-1838	EF 137 Room 135 Lab Hood
X-710-B-1841	EF 136 Room 135 Lab Hood
X-710-B-1847	EF 134 Room 135 Lab Hood
X-710-B-1849	EF 135 Room 135 Lab Hood
X-720-A-1874	Grit Blasting Room
X-720-A-1545	Motor Shop Steam Cleaning Booth
X-720-A-1904	X-720 Burn Off Oven
X-720-B-1515	Sample Bottle Exhaust

Certification

I certify under penalty of law that I have personally examined and am familiar with the information submitted herein and based on my inquiry of those individuals immediately responsible for obtaining the information, I believe that the submitted information is true, accurate, and complete representation of the emissions under United States Enrichment Corporation control. I am aware that there are significant penalties for submitting false information including the possibility of fine and imprisonment (see 18 U.S.C. 1001).

Name: T. Michael Taimi
USEC Environmental Assurance and Policies Manager

Signature: T. Michael Taimi Date: 6/18/98